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DEVELOPMENTS IN THE SOVIET COMPUTING MACHINE AND TYPEWRITER INDUSTRY

[Numbers in parentheses refer to list of appended sources.]

SOVIET COMPUTING MACHINES

The following article describes the various types of calculating machines and computing-analyzing machines which are currently being produced or are planned for the future.

Calculating Machines

Glavpoligrafmash (Main Administration for Polygraphic-Machine Building) is producing machines for mechanizing two basic types of computing operations: approximate calculations, such as are required in scientific research and planning organizations; and exact calculations, such as are necessary for bookkeeping and statistical computations in economic organizations.

Whereas adding machines serve to mechanize computing operations in the various organizations concerned with the national economy, mathematical machines and computing-solving devices are widely used in the mechanization of cumbersome, labor-consuming calculations in scientific research and planning organizations. They also serve to work out special problems. Calculating machines and computing-analyzing machines are equally necessary in all branches of the national economy, science, and engineering which have a suitable volume of operations. Calculating machines, especially arithmometers, are by far the most prevalent types.

The arithmometer system, used in many foreign countries as well as in the USSR, is the work of the Russian engineer, Odner.

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Lever arithmometers of the Feliks type are those most commonly used in the USSR. Their structure has been tested in diverse computing operations throughout the last 30 years. Thus far, arithmometers have served chiefly for arithmetical operations such as multiplication and division, when a small bulk of calculating operations is involved. Feliks arithmometers are used extensively as a secondary expedient in a manual computing system. They are often found in a manual computing system. They are often found in calculating and accounting offices.

In 1949 the Moscow SAM (Computing-Analyzing Machine) Plant produced ten experimental models of the Feliks-type arithmometer, modernized according to the plan of engineer A. I. Khokhlov. This year, a series of modernized arithmometers which, as a result of simple structural changes, will have substantial advantages, is in production.

In the first place, when two 9-digit numbers are multiplied, an accurate 9-digit result is obtained in one operation, without removal of the initial numbers. (The ordinary 9-space arithmometer gives only 4-6 digits in the result.) The extra digits accumulated by the machine are rejected in the result-counter. This is in accordance with the principles governing approximate calculations, which are sufficient for technical estimates.

In the second place, the capacity of the new machine is doubled in the case of division. When one 9-digit number is divided by another, an accurate 9-digit quotient is obtained.

Thirdly, when calculations involve numbers longer than 4 digits, some of the disks of the (setting) drum appear at the ends of the result-counter. Thus the load on the shaft is reduced, and long lines of unnecessary figures do not appear in the result.

It is possible that the system of A. I. Khokhlov will also be used in another group of computing machines, to enlarge spacing capacity and increase accuracy.

Series production of the VK-2 ten-key calculating machine, with motor drive, must be mastered in 1950. The result-counter has a capacity of 13 spaces; the revolution counter, eight; the setting drum, nine. Its speed is 300 revolutions per minute; dimensions are 290 x 250 x 160 millimeters; weight, 14 kilograms. It performs addition, subtraction, semiautomatic multiplication, and automatic division. The figures punched appear in the sight-holes, and are automatically rejected after the operating cycle is completed. The machine, a substitute for the lever-setting arithmometer, is much more productive. Its performance of addition and subtraction is most efficient.

Other experimental models of calculating machines must be put out in 1950 on the basis of the VK-2 type, namely Vk-1, with manual drive, and VK-3, which is motor-driven and automatic. All four arithmetical operations can be performed automatically on the VK-3 machine.

Computing-printing calculators include experimental models of the VD-110 calculating machine and the VDA-345 billing machine, put out in 1949. These types may be proposed for series production in 1951.

The VD-110 computing-printing calculator, with ten keys and motor drive, is intended to perform the four arithmetical operations, and record the results on a paper roll 70 millimeters wide. It has a revolution counter and a reproducing counter for accumulating intermediate sums or repeated numbers. A 12-digit number can be punched on the keyboard; a maximum of 16 digits may appear in the total. A space-indicator shows the number of keys struck, and a correction lever rejects a figure punched by error. Speed of the computing

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mechanism is 400 revolutions per minute; of the printing mechanism, 100 revolutions per minute. The machine is driven by a universal 20-watt motor with a speed of 6,000 revolutions per minute. Size of the machine is 420 x 280 x 200 millimeters; weight is 16-18 kilograms.

The function of the VDA-345 full-text billing machine, which has ten keys and motor drive, is to write out invoices and statements in connection with stock accounting and bookkeeping operations. It performs all four arithmetical operations and automatically computes the results. It is equipped with a typewriting unit, which prints the required text. Rated speed of the computing mechanism is 400 revolutions per minute; speed of the printing mechanism, 1,000 revolutions per minute. It is driven by a universal 40-watt motor with a speed of 6,000 revolutions per minute. A 12-digit number can be punched on the keyboard; a figure struck by error is rejected by a correction lever. The machine has a 16-space reproducing counter and two 12-space totaling counters for accumulating intermediate totals or repeating necessary numbers. The result of the computing operations in division is expressed in 8 digits; in multiplication, 16; in addition and subtraction, 12. The printing mechanism has 16 figured printing bars, two bars for balance symbols, one for symbols of the computing operation, and one for the comma. The bookkeeping carriage, which is 60 centimeters wide, has a special device for inserting log-forms. A detachable box of plugs for automatically engaging the counters is mounted on the sliding part of the carriage. The carriage is automatically moved to the proper column, and returns to its initial position. Dimensions of the machine are 295 x 560 x 715 millimeters; weight is 40-60 kilograms.

All the models of computing machines described above are of the ten-key type. They can therefore be operated by the "blind method," which produces greater efficiency. Designs of the computing and printing mechanisms represent only various modifications of the same plan. Several machines, including the SDU-110, SDU-110 M, and VK, were evolved from the same basic technological design. In the development of Models SD-210, VD-110, and VDA-345, for the first time in the history of computing-machine building, a practical attempt was made to standardize, and then to unify the machines by selecting one of four models as a basis. Because most of the units are interchangeable and the parts identified to a maximum degree, the total number of items constituting parts has been reduced by three times. This fact should be helpful in organizing mass production of computing machines in our plants, and to extensive cooperation among the plant-producers.

Computing-Analyzing Machines

From 1947 to 1949, series output of 45-column computing-analyzing machines was mastered by the computing-machine building plants. These machines include the T-4M tabulator; the PD 45-1, G. M. Pavlov's two-cycle perforator; the K 45-1, Dulgor'yan's controller; the S 45-1 sorter; and the PI 45-1 one-cycle totaling perforator.

Although some of these machines were put out in the USSR before outbreak of the war, production of all computing machines was discontinued at that time. They are now being put back into production in modernized form, and in some cases with radical changes in the mathematical and technical scheme. In 1949, the 45-column tabulator was modernized and adapted to totaling perforation. It was put into series production under the type designation T-5MI. It was on the basis of this group that a set of 80-column computing-analyzing machines was planned.

Experimental models of the new set will be put out in 1950, and series production is also expected to begin this year. The set includes a tabulator, one-cycle perforator, controller, sorter, automatic calculating (multiplying) perforator, and reproducer. Plans for an SP 80-1 sorting-selecting machine and a PI 80-1 one-cycle totaling perforator are also getting under way.

The T 80-1 eighty-column tabulator is an electromechanical computing machine for automatic processing of "perfocards." These are cards on which the figures contained in the original document have been recorded by means of a definite system of holes. The machine is able to add, subtract, and print the readings of each card, as well as to print totals, signs, and symbols. Attachment of a totaling perforator has been provided for. The tabulator does not have direct balance-striking facilities or universal current supply.

The T 80-1 tabulator was designed on the basis of 45-column tabulator T-4M, from which about 50 percent of its parts were derived. Productivity is 150 cards per minute in the totaling operations; 100, in the printing operations. Capacity of the computing sections is 88 characters; of the printing mechanism, 83. Totals are limited to 20 perfocard columns. The machine has 14 positions. Size is 1,400 x 800 x 1,100 millimeters; weight is 800 kilograms. It is driven by a 110-volt, 170-watt direct current motor with speeds of 860 and 1,800 revolutions per minute.

The T 80-1 is the first Soviet model of an 80-column tabulator which answers operational requirements. Like the D-11, it represents a significant step forward in tabulator designing. However, it is only an intermediate stage in the development of a tabulator of advanced design, which must fulfill to the maximum degree the requirements of mechanized computing operations, utilizing all the latest achievements in this field.

The P 80-2 one-cycle perforator, designed on the basis of the PI 45-1 machine, was intended for punching the original computing data on perfocards. It requires 0.1 second for punching one perfocard-column; 0.65 second for automatic rejection of one card and delivery of another. Capacity of the magazines is 400-500 perfocards. Dimensions of the machine are 1,000 x 450 x 850 millimeters; weight is 150 kilograms. It is driven by a 127-volt, 55-watt MSh-627 motor, which operates on alternating current at 2,800-3,000 revolutions per minute.

The K 80-1 controller, designed on the basis of the K 45-1 model, regulates the punching by accumulating the original data. Productive capacity is about 260 cards per hour. The magazine of cards under control holds about 200 perfocards; the magazine of completed cards, about 220. Size of the machine is 650 x 250 x 120 millimeters; weight is 16 kilograms. It is driven by a 110-volt, 25-watt MSh-627 motor operating on alternating current at 1,800 revolutions per minute.

The S 80-1 sorting machine, designed on the basis of the S 45-1, was intended for distributing the 80-column perfocards by group, depending on the requirements of the operation. Productivity is 450 perfocards per minute. Capacity of the feeding mechanism is 900 cards; of the receiving pockets, 700 cards. Size is 1,500 x 500 x 1,200 millimeters; weight is 400 kilograms. It is driven by a 127/220-volt, 0.25-kilowatt motor operating on alternating current, at 1,400 revolutions per minute. Internal electric circuits are supplied with direct 110-volt current.

The PU 80-1 automatic calculating (multiplying) perforator was designed for processing 80-column perfocards, multiplying the original data recorded on them, and punching the products on the same cards. Productivity ranges from 1,100-625 calculations per hour. It is driven by a 120/220-volt, 40-kilowatt motor on alternating current. A 50-volt direct-current generator and a 78-volt alternating-current motor supply the internal electric circuits. The machine measures 1,015 x 490 x 1,010 millimeters, and weights 790 kilograms.

The PV 80-1 reproducer was intended for making duplicates of 80-column perfocards. The machine can perform series perforation from one or several models and duplicate the punching in any given columns of the new cards. It is equipped with a selecting apparatus and a special mechanism which automatically checks the duplicate punched cards with the model. It operates on direct current. Speed is about 100 cards per minute; size is 800 x 500 x 1,200 millimeters; weight is 200 kilograms.

The machines already produced have been widely used not only for planning, bookkeeping, and statistics, but also for astronomical, mathematical, and other scientific calculations.

In spite of considerable expenditure for mechanization (cost of the machines, perfocards, and technical maintenance), the cost of machine-processing is in one unit, 83 percent; in three units. 36 percent; and in five units, only 27 percent of the cost of hand-processing. The great productivity of the machine and its capacity for continuous preliminary storing of perfocards are greatly speeding up the processing period. In comparison with manual processing, labor consumption is reduced in many cases more than 50 percent.

At small additional expense (about 20 percent of the cost of basic processing), punched cards containing all the original data can be processed repeatedly at a high rate of speed in the different units of the machine.

Great simplification of the computing operations and reduction in the number of steps involved are making possible freer and easier manipulation, while the clear division of labor into separate elementary operations facilitates the utilization of less highly skilled personnel. -- N. A. Ignatov, Engineer (1)

DATA ON TYPEWRITER AND COMPUTING MACHINE PRODUCTION

The following news items indicate recent developments in the Soviet typewriting and computing machine industry from July 1949 to April 1950.

Shortage of Machines

Jul 49: In the next 4-6 years, 15 times the present number of calculating machines will be needed. During 1949 alone, tens of thousands of rubles have been spent on construction and restoration of plants which produce these machines.

In large organizations which require a great amount of computing work, machines are being centered in calculating stations. For small and medium-sized enterprises there are calculating offices, in which only key-operated machines are used. Forty calculating stations and 500 calculating offices must be completed during 1949.

Machine-calculation exclusively must be the rule for the automobile, machine-building, and aviation industries by the end of 1949. Studies of its use here will lead to the extension of mechanical calculation to other ministries and departments.

The Ministry of Machine and Instrument Building has failed to meet production deadlines. The Penza Plant is especially slow in getting new calculating machines into production.(2)

New Stations

15 Sep 49: Computing and analyzing machines have been installed in the Sverdlovsk Oblast branch of the Gosbank, where a machine accounting Station is being equipped. Twenty-three rayon divisions of the Gosbank already have adding machines.(3)

25 Nov 49: The Zaporozh'ye Kommunar Combine-Building Plant has added a new shop, an adding machine station, equipped with the latest automatic machines. All bookkeeping operations, previously done by hand, are now handled by machine.(4)

3 Dec 49: A machine accounting station has been set up under the Latvian Republic of the Gosbank, USSR. The station has highly complex tabulating machinery of domestic construction.(5)

Typewriter Plant

25 Aug 49: The Portable Typewriter Plant of the Mosgormestprom (Moscow City Local Industry) Trust has completed its Five-Year Plan in 3 years, 4 months, and 26 days. Several hundred new Moskva portables, planned for the 1951 schedule, have already been produced at a considerable reduction in price. Serial numbers o this Moskva model have reached the 21,000 mark.(6)

Computing-Analyzing Machine Plant

12 Sep 49: The computing-Analyzing Machine Plant of the Ministry of Machine and Instrument Building USSR is one of the leading plants in the competition among enterprises of the ministry. The typewriter shop has pledged to put out 1,500 typewriters above the plan in 1949. The tabulating machine shop has pledged 20 complex computing and analyzing machines. The arithmometer shop and the machine shop will make a large quantity of parts above the plan.(7)

15 Sep 49: The plant is making an all-out effort to complete its Five-Year Plan by 7 November. The basic parts of the central mechanism of the Moskva typewriter are now produced by pressure casting. The use of this method has resulted in great savings, and has freed a part of the machinery for other operations.(8)

10 Oct 49: The plant has been awarded the Red Banner by the ministry for its work during the first and second quarters of 1949. Today, it began work on the December plan. The adding machine shop has already completed its annual plan. Latent reserves will permit the plant to produce its pledged 1,500 typewriters and a considerable number of tabulators above the plan.(9)

29 Oct 49: Labor-saving devices at the plant yielded 500,000 rubles in savings during the first 9 months of 1949.(10)

18 Apr 50: The lacquering and galvanizing shops have pledged to economize by working 2 days per month on salvaged materials. Other shops are carrying on a similar drive. The typewriter shop has promised to put out 150 machines above the plan by 1 May, and to assemble five experimental machines from parts made by pressure casting.(11)

New Developments

25 Oct 49: S. V. Minin, instructor at the Vsevolozhskiy Agricultural School, has invented a new calculating device, the Molniya, for use by collective farm brigadiers. It computes norm-fulfillment and pay due individual workers and the brigade as a whole. It can also figure food rations.

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Unlike other calculating devices, the machine can simultaneously divide, multiply, solve equations, and take square roots. Twenty-four models have been produced. The machines are suitable for use in industry as well as on collective farms.(12)

23 Nov 49: The new calculating devices can also be used in geodetic operations.(13)

26 Mar 50: Enterprises of the Ministry of Machine and Instrument Building, USSR, have put into production a number of new computing and analyzing machines. These include adding, calculating, computing-analyzing, and higher-mathematics machines. The new SDU-110, a 10-key calculating typewriter, has found wide practical application. It was designed for complex adding, subtracting, and bookkeeping operations, involving the striking of balances. The rate of this machine in performing additions and subtractions of 5-digit numbers in columns of 25 items is 1,950 calculations per hour. The same machine with motor drive can reach a speed of 2,700 calculations per hour.(14)

22 Mar 50: Speed of the SDU-110 machine with motor drive is 2.5 times as fast as that of the ordinary abacus.

Machines put out for work in higher mathematics include the electron-tube integrator and the electronic calculating machine.(15)

23 Apr 50: A scientist from the Leningrad Electrical Engineering Institute imeni V. I. Ul'yanov has assisted the Computing-Machine Plant to work out a new design and technology for production of low-power motors. He has made it possible for the plant to master the output of computing machines with miniature electric motors.(16)

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